NOTICE OF CONTRACT ACTION (NOCA)
BROAD AGENCY ANNOUNCEMENT (BAA) * BAA-RQKS-2016-0002
Research and Development for Electro-Optical Frequency Sensors (RADERS)

BROAD AGENCY ANNOUNCEMENT TITLE: Research and Development for Electro-Optical Frequency Sensors (RADERS)

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*************This announcement does not request any white papers or proposals at this time*************

The following topic is an anticipated requirement for AFRL/RY. A BAA requesting proposals for this topic is anticipated to be published.

The anticipated funding listed below reflects estimated funding only. This estimate is not a promise of funding. Funding is uncertain and is subject to change. Changes in availability may occur at the discretion of the Government.

Program Description: The Air Force Research Laboratory Multispectral Sensing and Detection Division (AFRL/RYM) intends to solicit White Papers for innovative and state-of-the-art research to enhance the following twelve fields:

1. Antenna Technologies and Electromagnetic Scattering: The objective of this research is to advance antenna and electromagnetic technology and phenomenology studies for air, ground and space-based applications including radar, communications, satellite operations, and intelligence, surveillance and reconnaissance systems (ISR) from HF to W-Band frequencies. In particular, the objective of this research is to advance the field of detection, tracking, and fusion of data of difficult targets in rapidly varying environments and contested electromagnetic spectrum utilizing broad and agile electromagnetic spectrum, advanced antenna and scattering theory as well as situational awareness methodologies and develop architectures and algorithms for ISR, navigation, communications.

2. Electro-optic and Infrared Sensor Technology: The objective of this research is to promote novel sensors, sensor technologies and algorithms for target sensing in general, and detection, recognition and tracking in particular. This can be done by any EO/IR waveband, phenomenology permitting. Modalities include, but are not limited to, thermal imaging, single-aperture EO/RF sensing, hyper- and multispectral sensing.

3. **Sensor Information Processing and Integration:** This topic addresses new approaches to the integration and understanding of massive amounts of data coming from diverse sensor platforms with the goal of developing actionable intelligence and achieving autonomous or semi-autonomous situation awareness. The fundamental difficulties include modeling and algorithms development for distributed active/passive sensing, computational complexity, massive amounts of disparate information, the need to integrate human and sensory input, cultural backgrounds, and the ability to identify and seek missing information.

4. Novel EO/IR, Spectral and Common Aperture EO/RF Hardware and Algorithms: This topic addresses the development of innovative hardware and algorithms to detect low-signal targets in noisy and heavily cluttered environments using EO, IR, hyperspectral, multispectral, and common-aperture EO/RF sensors. Of great importance is leveraging system benefits or information advantages yielded by multispectral EO/RF approaches. Included in this area are new ideas for design and development of sensors, focal plane arrays (FPA), hybrid FPAs and infrared cameras for high-resolution, low-power, lightweight, low-cost, portable midwave and longwave infrared sensing.

5. Waveform Phenomenology, Design and Applications: This topic addresses the development of innovative techniques concentrated on identifying and capitalizing on signal phenomenology that gives rise to new and difficult-to-detect RF waveforms. Waveform agility is the foundation of this research which takes advantage of all possible degrees of freedom, and explores noise-like waveforms, interference-tolerant waveforms, and low probability of intercept, low probability of detection, and low-probability of exploitation (LPI/LPD/LPE) waveforms.

6. Ultra-Sensitive Receivers for Signals Intelligence: This topic addresses comprehending the physics-based relationship between a receiver noise floor and sensitivity. Parameters such as temperature and bandwidth should offer a multi-dimensional representation of signal to noise (SNR) dynamic range, and in the case of complex signals of interest, instantaneous dynamic range (IDR). This is often defined as the measurement of a weak signal in the presence of a strong one or as a signal buried far below a dense RF interference background. Innovations in receiver architectures will be required as well as novel methods for characterizing signals as a function of frequency separation. Design of Experiments using physical modeling and simulation tools is desired in developing RF receiver architectures and appropriate statistical analysis. The formulation of RF laboratory experiments for prototyping of ultra-sensitive receiver sub-systems integrated with beam-forming antenna/aperture assemblies for future defense applications is needed. Recently completed research at AFRL has revealed opportunities for the development of non-traditional RF receiver architectures which bridge quantum physics and RF technologies as a multidisciplinary area to address fundamental limitations (e.g., sampling jitter, thermal noise, Nyquist/Shannon theorem limitations) to more efficiently convert a signal from the RF to an encoded digital format. The long-term research goal is to enable a RF receiver capable of sequential search and analysis modes under dense/complex signal conditions to enable revolutionary sensor payloads.

7. Long Range Day/Night Hyperspectral Imaging Research: The objective of this research is to develop day/night hyperspectral component technologies for enhanced material detection and identification at extended ranges, including the design and manufacture of the enabling component technologies (cryocoolers, FPAs, spectrometers, etc.) as well as sensor system design trades and development for airborne flight demonstrations of the integrated component technologies. Includes signal processing and algorithm development to keep up with the phenomenology and modeling required to automatically detect and identify extended range targets.

8. Standoff High Resolution Imaging: The objective of this research is to advance the field of long range imaging to achieve current resolutions at double the range, and to bring mid-wavelength infrared (MWIR) imaging performance up to current EO capability in order to access high resolution motion imagery in Anti-Access/Area Denial (A2/AD) engagements. The approach uses high performance components for EO and MWIR including large-format high operating temperature imaging/video arrays, reduced detector size and high speed, low noise sampling and readout. Developing and applying advanced techniques and algorithms to achieve diffraction limited performance from slightly modified systems is of interest.

9. Infrared Search and Track Technology: The objective of this research is to develop an advanced long range and wide field of view staring infrared search and track (IRST) system that provides state-of-the-art performance. Currently fielded IRST systems are based on longwave scanning sensors where typical performance is dictated by the scan dwell time and revisit rate. An improved staring system would allow operation at video rates, giving faster track initiation.

This research area potentially leverages the latest technology of large infrared FPAs with High Operating Temperature (HOT) detectors to eliminate a large cooler thus reducing system size and weight, small pixel pitch which provide better image resolution, and digital read out integrated circuits (ROICs) versus analog. The challenge is to provide range resolution to aid in a robust, precise weapons quality track.

The objective is to develop an IRST conceptual design that supports the generation of fire control solutions at range along clear atmospheric paths and in cluttered air-to-air and air-to-ground environments with a low false alarm rate while staring over the entire system field of regard. The trade space to be considered includes current and future advancements in large format FPAs, innovative read-out architectures, sensor chip assembly designs, innovative wide field of view optical designs, and advanced processing methods for target detection/tracking at range and in clutter that fully exploit the high frame rate advantages of a staring system. Research should take into account total system life cycle costs and identify alternatives to high cost, high failure rate and high maintenance items such as thermal infrared transparent conformal window materials. Additionally, basic algorithms and supporting processing architecture suitable for performance validation and verification of the system and target detection including tracking and clutter rejection algorithms will be investigated and evaluated.

10. Passive Concept Exploration: The objective of this research is to develop/apply new novel EO passive sensing technologies to difficult sensing problems to find revolutionary solutions.

11. Laser Radar Imaging, Systems, Components, and Applications: The objective of this research is to develop innovative laser radar based approaches for ISR, precision attack and air-to-air engagements. This may include new techniques, phenomenologies, hardware and algorithms to detect, track and especially identify difficult air and ground targets in challenging environments. Included in this area are new ideas for fundamental measurement concepts, design and development of sensors, active FPAs with integrated ROICs as well as flight laser systems and components. Both direct detection and coherent ladar systems are of interest including, but not limited, to 1-D, 3D, synthetic aperture, holographic aperture and vibration imaging modes.

12. RF Sensor Systems Technology: This research investigates evolutionary and revolutionary improvements to RF sensing systems for situational awareness and targeting applications. Active (monostatic) radar is the traditional workhorse for long-range surveillance and all-weather targeting. Signals Intelligence (SIGINT) is central in understanding adversary sensing capabilities and deployments by measuring their RF emissions. Modern Integrated Air Defense systems are forcing blue sensing platforms to greater distances, leading to the current emphasis on learning how to operate in an A2/AD environment. The agility of these advanced IADS is one factor driving SIGINT to be done on faster time scales, becoming ever closer to the tactical timescales required by Electronic Support Measures (ESM) receivers. While monostatic radar provides its own transmitter, and SIGINT collects information on emitters, bistatic radars separate the transmitter from the receiver while passive radars use emitters already operating in the environment. Bistatic and passive radar is thus seen to occupy a middle ground between monostatic radar and SIGINT, and is a fertile area for investigation of multifunction RF systems.

General Operations Security (OPSEC) procedures, policies and awareness are required in an effort to reduce program vulnerability from successful adversary collection and exploitation of critical information. OPSEC will be applied throughout the life cycle of the contract. The Critical Information List (CIL) will be provided upon request by RYOY Information Protection Office. While working on the government installation, OPSEC guidance will be provided by the RYOY Information Protection Office.

The contractor shall be required to deliver all hardware, software, and associated data developed and utilized in the development of any resulting contract. It is anticipated that a BAA providing details into this program will be released in the November/December 2015 timeframe; the BAA will be made available at www.fbo.gov. Other business opportunities for AFRL are also available at www.fbo.gov. Any questions may be directed to the contracting or technical points of contact listed in the announcement.

Anticipated Contract Type: Multiple Cost-Plus-Fixed-Fee (CPFF) contracts are anticipated.

Anticipated Funding: Total Program: $49,000,000. Range of $100,000 **-** $10,000,000 per contract.

Place of Contract Performance: Air Force Research Laboratory (AFRL), Sensors Directorate, Wright-Patterson Air Force Base, OH

Set Aside: None

THIS IS NOT A CALL FOR PROPOSALS.
DO NOT SUBMIT PROPOSALS AT THIS TIME.
ANY PROPOSALS RECEIVED WILL BE DISREGARDED.